Virginia

Standards of Learning Assessments

Mathematics Test

Cumulative Blueprint Grades 6, 7, and 8

for the

2001 Mathematics Standards of Learning

for Modified Standard Diploma students only

Mathematics Grade 8 Blueprint

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Standards of Learning (SOL) Test Blueprint

Introduction

What is a test blueprint?

A test blueprint is a guide for test construction and use. The Standards of Learning (SOL) test blueprints serve a number of purposes. They serve as a guide to test developers as they write test questions and construct the SOL tests. These blueprints also serve as a guide to educators, parents, and students in that they show:

(a) the SOL covered by the test and which, if any, have been excluded;
(b) which SOL are assigned to each reporting category;
(c) the number of test items in each reporting category and on the total test;
(d) general information about how the test questions were constructed; and
(e) the materials that students are allowed to use while taking the test.

How is the test blueprint organized?

The blueprint contains the following information:

1. **Test Development Guidelines:** guidelines used by the testing contractor and the members of the Content Review Committees in developing the SOL tests. This section contains two parts:

   A. General Considerations — lists general considerations that are used in developing the test as well as considerations specific to a particular content area.

   B. Ancillary Materials — lists any materials that students are allowed to use while taking the test.

2. **Blueprint Summary Table:** a summary of the blueprint which displays the following information:

   - reporting categories for the test;
   - number of test items in each reporting category;
   - Standards of Learning (SOL) included in each reporting category. SOL are identified by numbers and letters that correspond to the original SOL document;
   - SOL which are excluded from the SOL test;
   - number of operational items on the test;
   - number of field-test items on the test; and
   - total number of items (operational and field-test items) on the test.

3. **Expanded Blueprint:** provides the same information as the Blueprint Summary Table except that the full text of each SOL is included.

What is a reporting category?

Each test assesses a number of SOL. In the test blueprint, SOL are grouped into categories that represent related content or skills. These categories are labeled *Reporting Categories*. For example, a reporting category for the Grade 5 Mathematics test is "Computation and Estimation." Each of the SOL in this reporting category addresses computation using addition, subtraction, multiplication, or division or requires the student to estimate the answer to a problem. When the results of the SOL tests are reported, the scores will be presented in terms of scores for each reporting category and a total test score.

Are some SOL assigned to more than one reporting category?

In grade 8 mathematics, each standard, as well as each letter under a standard, is assigned to only one reporting category.

Will all SOL listed in the blueprint be assessed each time the SOL tests are given?

Each SOL will not be assessed on every SOL test form. To keep the length of a test reasonable, the test will measure a selection of the SOL within a reporting category. However, every SOL that is not excluded in the blueprint is eligible for inclusion on each form of an SOL test. Over time all SOL in a reporting category will be assessed.

Grade 8 Mathematics Test Development Guidelines

A. General Considerations

1. All items included in this test will address the knowledge and skills specified in the 2001 Virginia Standards of Learning in mathematics for grade 8.

2. Items will be examined for any content or context that stereotypes, offends, or unfairly penalizes students based on age, gender, economic status, race, ethnicity, religion, or geographic region.

3. The test will be untimed.

4. There is no penalty for guessing. Students' scores will be based on the number of correct answers out of the total number of operational items on the test.

5. Where appropriate, "real-life" examples and situations that the student would likely encounter will be used to present data or ask questions.

6. Items will be grade-appropriate in terms of difficulty, interest, and reading level.

7. Students will be permitted scratch paper at any time during the test.

8. Students will be permitted to use a state approved scientific calculator during the test.

9. Students will be provided a formula sheet and an approximation for pi (π). A copy of the formula sheet follows the expanded blueprint.

B. Ancillary Materials

Refer to the current examiner's manual or the Department of Education's Web site for ancillary materials that may be used.

Grade 8 Mathematics Blueprint Summary Table

Reporting Categories	No. of Items	Grade Six SOL	Grade 7 SOL	Grade 8 SOL
Number and Number Sense	**8**	6.1 6.2 6.3a,b,c 6.4 6.5	7.1 7.2 7.3a,b,c,d,e	8.1a,b,c 8.2
Computation and Estimation	**7**	6.6a,b 6.7 6.8	7.4a,b 7.5 7.6	8.3 8.4 8.5
Measurement and Geometry	**15**	6.9a,b,c,d 6.10 6.11 6.12a,b 6.13a,b 6.14 6.15 6.17	7.7a,b 7.8 7.9 7.10 7.11 7.12 7.13	8.6 8.7 8.8 8.9 8.10a,b
Probability and Statistics	**12**	6.18a,b,c 6.19 6.20a,b	7.14 7.15 7.16 7.17a,b,c,d,e,f 7.18	8.11 8.12 8.13
Patterns, Functions, and Algebra	**18**	6.21 6.22 6.23a,b,c	7.19 7.20 7.21 7.22a,b	8.14a,b 8.15 8.16 8.17 8.18
SOL Excluded from This Test		6.16	None	None

Total Number of Operational Items	**60**
Field Test Items*	**10**
Total Number of Items	**70**

*These field test items will *not* be used to compute students' scores on the test.

Expanded Blueprint

Reporting Category: Number and Number Sense
Number of Items: 8

Grade Six SOL in This Reporting Category:

6.1 The student will identify representations of a given percent and describe orally and in writing the equivalence relationship among fractions, decimals, and percents.

6.2 The student will describe and compare two sets of data, using ratios, and will use appropriate notations, such as *a/b*, *a* to *b*, and *a:b*.

6.3 The student will
a) find common multiples and factors, including least common multiple and greatest common factor;
b) identify and describe prime and composite numbers; and
c) identify and describe the characteristics of even and odd integers.

6.4 The student will compare and order whole numbers, fractions, and decimals, using concrete materials, drawings or pictures, and mathematical symbols.

6.5 The student will identify, represent, order, and compare integers.

Grade Seven SOL in This Reporting Category:

7.1 The student will compare, order, and determine equivalent relationships between fractions, decimals, and percents, including scientific notation for numbers greater than 10.

7.2 The student will simplify expressions that contain rational numbers (whole numbers, fractions, and decimals) and positive exponents, using order of operations, mental mathematics, and appropriate tools.

7.3 The student will identify and apply the following properties of operations with real numbers:
a) the commutative and associative properties for addition and multiplication;
b) the distributive property;
c) the additive and multiplicative identity properties;
d) the additive and multiplicative inverse properties; and
e) the multiplicative property of zero.

Reporting Category: Number and Number Sense (continued)
Number of Items: 8

Grade Eight SOL in This Reporting Category:

8.1 The student will
- a) simplify numerical expressions involving positive exponents, using rational numbers, order of operations, and properties of operations with real numbers;
- b) recognize, represent, compare, and order numbers expressed in scientific notation; and
- c) compare and order decimals, fractions, percents, and numbers written in scientific notation.

8.2 The student will describe orally and in writing the relationship between the subsets of the real number system.

Reporting Category: Computation and Estimation
Number of Items: 7

Grade Six SOL in This Reporting Category:

6.6 The student will
- a) solve problems that involve addition, subtraction, multiplication, and/or division with fractions and mixed numbers, with and without regrouping, that include like and unlike denominators of 12 or less, and express their answers in simplest form; and
- b) find the quotient, given a dividend expressed as a decimal through thousandths and a divisor expressed as a decimal to thousandths with exactly one non-zero digit.

6.7 The student will use estimation strategies to solve multistep practical problems involving whole numbers, decimals, and fractions (rational numbers).

6.8 The student will solve multistep consumer-application problems involving fractions and decimals and present data and conclusions in paragraphs, tables, or graphs. Planning a budget will be included.

Grade Seven SOL in This Reporting Category:

7.4 The student will
- a) solve practical problems using rational numbers (whole numbers, fractions, decimals) and percents; and
- b) solve consumer–application problems involving tips, discounts, sales tax, and simple interest.

Reporting Category: Computation and Estimation (continued)
Number of Items: 7

Grade Seven SOL in This Reporting Category (continued):

7.5 The student will formulate rules for and solve practical problems involving basic operations (addition, subtraction, multiplication, and division) with integers.

7.6 The student will use proportions to solve practical problems, which may include scale drawings, that contain rational numbers (whole numbers, fractions, and decimals), and percents.

Grade Eight SOL in This Reporting Category:

8.3 The student will solve practical problems involving rational numbers, percents, ratios, and proportions. Problems will be of varying complexities and will involve real-life data, such as finding a discount and discount prices and balancing a checkbook.

8.4 The student will apply the order of operations to evaluate algebraic expressions for given replacement values of the variables. Problems will be limited to positive exponents.

8.5 The student, given a whole number from 0 to 100, will identify it as a perfect square or find the two consecutive whole numbers between which the square root lies.

Expanded Blueprint

Reporting Category: Measurement and Geometry
Number of Items: 15

Grade Six SOL in This Reporting Category:

6.9 The student will compare and convert units of measure for length, area, weight/mass, and volume within the U.S. Customary system and within the metric system and estimate conversions between units in each system:
- a) length—part of an inch (1/2, 1/4, and 1/8), inches, feet, yards, miles, millimeters, centimeters, meters, and kilometers;
- b) weight/mass—ounces, pounds, tons, grams, and kilograms;
- c) liquid volume—cups, pints, quarts, gallons, milliliters, and liters; and
- d) area—square units.*

* *The intent of this standard is for students to make ballpark comparisons and not to memorize conversion factors between U.S. customary and metric units.*

6.10 The student will estimate and then determine length, weight/mass, area, and liquid volume/capacity, using standard and nonstandard units of measure.

6.11 The student will determine if a problem situation involving polygons of four or fewer sides represents the application of perimeter or area and apply the appropriate formula.

6.12 The student will
- a) solve problems involving the circumference and/or area of a circle when given the diameter or radius; and
- b) derive approximations for pi (π) from measurements for circumference and diameter, using concrete materials or computer models.

6.13 The student will
- a) estimate angle measures, using 45°, 90°, and 180° as referents, and use the appropriate tools to measure the given angles; and
- b) measure and draw right, acute, and obtuse angles and triangles.

6.14 The student will identify, classify, and describe the characteristics of plane figures, describing their similarities, differences, and defining properties.

6.15 The student will determine congruence of segments, angles, and polygons by direct comparison, given their attributes. Examples of noncongruent and congruent figures will be included.

6.17 The student will sketch, construct models of, and classify solid figures (rectangular prism, cone, cylinder, and pyramid).

Reporting Category: Measurement and Geometry (continued)
Number of Items: 15

Grade Seven SOL in This Reporting Category:

7.7 The student, given appropriate dimensions, will
a) estimate and find the area of polygons by subdividing them into rectangles and right triangles; and
b) apply perimeter and area formulas in practical situations.

7.8 The student will investigate and solve problems involving the volume and surface area of rectangular prisms and cylinders, using concrete materials and practical situations to develop formulas.

7.9 The student will compare and contrast the following quadrilaterals: parallelogram, rectangle, square, rhombus, and trapezoid. Deductive reasoning and inference will be used to classify quadrilaterals.

7.10 The student will identify and draw the following polygons: pentagon, hexagon, heptagon, octagon, nonagon, and decagon.

7.11 The student will determine if geometric figures - quadrilaterals and triangles - are similar and write proportions to express the relationships between corresponding parts of similar figures.

7.12 The student will identify and graph ordered pairs in the four quadrants of a coordinate plane.

7.13 The student, given a polygon in the coordinate plane, will represent transformations – rotation and translation – by graphing the coordinates of the vertices of the transformed polygon and sketching the resulting figure.

Grade Eight SOL in This Reporting Category:

8.6 The student will verify by measuring and describe the relationships among vertical angles, supplementary angles, and complementary angles and will measure and draw angles of less than 360°.

8.7 The student will investigate and solve practical problems involving volume and surface area of rectangular solids (prisms), cylinders, cones, and pyramids.

Expanded Blueprint

Reporting Category: Measurement and Geometry (continued)
Number of Items: 15

Grade Eight SOL in This Reporting Category (continued):

8.8 The student will apply transformations (rotate or turn, reflect or flip, translate or slide, and dilate or scale) to geometric figures represented on graph paper. The student will identify applications of transformations, such as tiling, fabric design, art, and scaling.

8.9 The student will construct a three-dimensional model, given the top, side, and/or bottom views.

8.10 The student will
- a) verify the Pythagorean Theorem, using diagrams, concrete materials, and measurement; and
- b) apply the Pythagorean Theorem to find the missing length of a side of a right triangle when given the lengths of the other two sides.

Reporting Category: Probability and Statistics
Number of Items: 12

Grade Six SOL in This Reporting Category:

6.18 The student, given a problem situation, will collect, analyze, display, and interpret data in a variety of graphical methods, including
- a) line, bar, and circle graphs;*
- b) stem-and-leaf plots; and
- c) box-and-whisker plots.

**Circle graphs will be limited to halves, fourths, and eighths.*

6.19 The student will describe the mean, median, and mode as measures of central tendency, describe the range, and determine their meaning for a set of data.

6.20 The student will
- a) make a sample space for selected experiments and represent it in the form of a list, chart, picture, or tree diagram; and
- b) determine and interpret the probability of an event occurring from a given sample space and represent the probability as a ratio, decimal, or percent, as appropriate for the given situation.

Reporting Category: Probability and Statistics (continued)
Number of Items: 12

Grade Seven SOL in This Reporting Category:

7.14 The student will investigate and describe the difference between the probability of an event found through simulation versus the theoretical probability of that same event.

7.15 The student will identify and describe the number of possible arrangements of several objects, using a tree diagram or the Fundamental (Basic) Counting Principle.

7.16 The student will create and solve problems involving the measures of central tendency (mean, median, mode), and range of a set of data.

7.17 The student, given a problem situation, will collect, analyze, display, and interpret data, using a variety of graphical methods, including
a) frequency distributions;
b) line plots;
c) histograms;
d) stem-and-leaf plots;
e) box-and-whisker plots; and
f) scattergrams.

7.18 The student will make inferences, conjectures, and predictions based on analysis of a set of data.

Grade Eight SOL in This Reporting Category:

8.11 The student will analyze problem situations, including games of chance, board games, or grading scales, and make predictions, using knowledge of probability.

8.12 The student will make comparisons, predictions, and inferences, using information displayed in frequency distributions; box-and-whisker plots; scattergrams; line, bar, circle, and picture graphs; and histograms.

8.13 The student will use a matrix to organize and describe data.

Expanded Blueprint

Reporting Category: Patterns, Functions, and Algebra
Number of Items: 18

Grade Six SOL in This Reporting Category:

6.21 The student will investigate, describe, and extend numerical and geometric patterns, including triangular numbers, patterns formed by powers of 10, and arithmetic sequences.

6.22 The student will investigate and describe concepts of positive exponents, perfect squares, square roots, and, for numbers greater than 10, scientific notation. Calculators will be used to develop exponential patterns.

6.23 The student will
- a) model and solve algebraic equations, using concrete materials;
- b) solve one-step linear equations in one variable, involving whole number coefficients and positive rational solutions; and
- c) use the following algebraic terms appropriately: *variable*, *coefficient*, *term*, and *equation*.

Grade Seven SOL in This Reporting Category:

7.19 The student will represent, analyze, and generalize a variety of patterns, including arithmetic sequences and geometric sequences, with tables, graphs, rules, and words in order to investigate and describe functional relationships.

7.20 The student will write verbal expressions as algebraic expressions and sentences as equations.

7.21 The student will use the following algebraic terms appropriately: *equation*, *inequality*, and *expression*.

7.22 The student will
- a) solve one-step linear equations and inequalities in one variable with strategies involving inverse operations and integers, using concrete materials, pictorial representations, and paper and pencil; and
- b) solve practical problems requiring the solution of a one-step linear equation.

Reporting Category: Patterns, Functions, and Algebra (continued)
Number of Items: 18

Grade Eight SOL in This Reporting Category:

8.14 The student will
- a) describe and represent relations and functions, using tables, graphs, and rules; and
- b) relate and compare tables, graphs, and rules as different forms of representation for relationships.

8.15 The student will solve two-step equations and inequalities in one variable, using concrete materials, pictorial representations, and paper and pencil.

8.16 The student will graph a linear equation in two variables in the coordinate plane, using a table of ordered pairs.

8.17 The student will create and solve problems using proportions, formulas, and functions.

8.18 The student will use the following algebraic terms appropriately: *domain, range, independent variable*, and *dependent variable*.

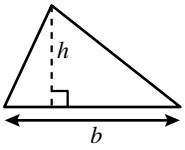
Grade Six SOL Excluded from This Test

The following SOL is not measurable in a multiple-choice format.

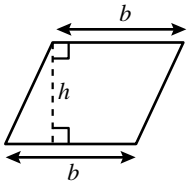
6.16 The student will construct the perpendicular bisector of a line segment and an angle bisector.

Grade 8 Mathematics Formula Sheet

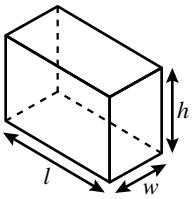
Geometric Formulas



$A = \frac{1}{2}bh$

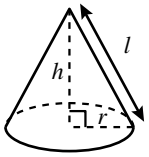


$A = bh$



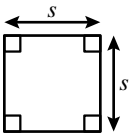
$V = lwh$

$S.A. = 2lw + 2lh + 2wh$



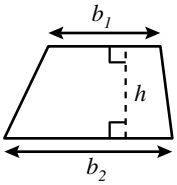
$V = \frac{1}{3}\pi r^2 h$

$S.A. = \pi rl + \pi r^2$

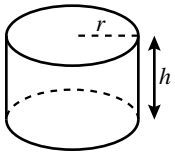


$p = 4s$

$A = s^2$

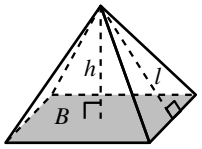


$A = \frac{1}{2}h(b_1 + b_2)$



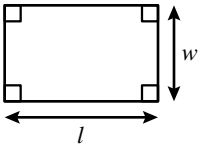
$V = \pi r^2 h$

$S.A. = 2\pi rh + 2\pi r^2$



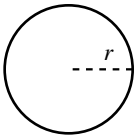
$V = \frac{1}{3}Bh$

$S.A. = \frac{1}{2}lp + B$



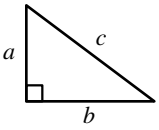
$p = 2l + 2w$

$A = lw$



$C = 2\pi r$

$A = \pi r^2$



$c^2 = a^2 + b^2$

Abbreviations

milligram	mg
gram	g
kilogram	kg
milliliter	mL
liter	L
kiloliter	kL
millimeter	mm
centimeter	cm
meter	m
kilometer	km
square centimeter	cm^2
cubic centimeter	cm^3

ounce	oz
pound	lb
quart	qt
gallon	gal.
inch	in.
foot	ft
yard	yd
mile	mi.
square inch	sq in.
square foot	sq ft
cubic inch	cu in.
cubic foot	cu ft

volume	*V*
total surface area	*S.A.*
area of base	*B*

year	yr
month	mon
hour	hr
minute	min
second	sec

Pi

$\pi \approx 3.14$

$\pi \approx \frac{22}{7}$

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